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Practical application of Australian Water Availability Project to estimate catchment water budget in a semi-arid region: the potentials and limitations

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Precipitation is the most important climate-forcing variable in hydrology cycle that significantly influences catchment water budgets. The typical use of precipitation stations across semi-arid regions, leads to inaccurate representation of precipitation pattern for hydrologic studies, owing to the limited spatial coverage and availability of in-situ measurements. Recently, gridded precipitation datasets have become available to overcome this drawback especially in water-limited regions such as Australia. However, gridded datasets with inherently smoothed variation may not be able to capture the spatio-temporal variations of precipitation. This study explores the potentials and limitation of using gridded precipitation datasets in hydrologic studies using a continuous semi-distributed catchment model and suggests improved approach to reduce the precipitation uncertainty using in-situ and remotely sensed data. The Soil and Water Assessment Tools (SWAT) model is applied to simulate hydrological processes at a monthly time step over the period of 2007-2014. The spatial patterns of predicted hydrological variables (i.e. soil moisture, streamflow, and vegetation) were compared against in-situ measurements and remotely sensed observations at multiple spatial scales. This spatial pattern comparison on the emergent hydrological properties provide insight onto the spatio-temporal variations and representativeness of precipitation input and helps to reduce the uncertainties on the model prediction. This study has been undertaken in Merriwa sub-basin located at the Goulburn River catchment, NSW, where the catchment has experienced high climate variation during the study period. This study site has been intensely monitored under the Scaling and Assimilation of Soil Moisture And Streamflow (SASMAS) project soil moisture network. SASMAS soil moisture and streamflow, and Leaf Area Index from MODIS (Moderate Resolution Imaging Spectroradiometer) will be used to investigate the AWAP precipitation patterns and its impacts on the estimated catchment budget. This research provides an improved technique considering the capability of implementation of gridded datasets for hydrologic researches. Whereas, critical role of hydrologic components across water-limited region with reasonable gridded precipitation amount and their distribution can be represented more accurately.

Keywords: Precipitation, AWAP, SWAT, streamflow, semi-arid region